

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band)	GN Docket No. 18-122
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Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz)	GN Docket No. 17-183 (Inquiry Terminated as to 3.7-4.2 GHz)
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Petition for Rulemaking to Amend and Modernize Parts 25 and 101 of the Commission's Rules to Authorize and Facilitate the Deployment of Licensed Point-to-Multipoint Fixed Wireless Broadband Service in the 3.7-4.2 GHz Band)	RM-11791
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Fixed Wireless Communications Coalition, Inc., Request for Modified Coordination Procedures in Band Shared Between the Fixed Service and the Fixed Satellite Service)	RM-11778
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COMMENTS OF LOCKHEED MARTIN CORPORATION

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TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION AND SUMMARY	2
II. DISCUSSION	4
A. The Commission Must Perform The Necessary Due Diligence	4
B. The Commission Must Ensure the Protection of C-Band Telemetry Operations, LEOP Services, Satellite Services Critical to Aviation, and Adjacent-Band Operations.	7
C. The Commission Has Not Considered Any International Ramifications of Its Proposed Reallocation of the 3.7-4.2 GHz Band from FSS to Wireless Broadband Services.	10
III. CONCLUSION	12

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To: The Commission

COMMENTS OF LOCKHEED MARTIN CORPORATION

Lockheed Martin Corporation ("Lockheed Martin") hereby provides its comments in response to the Commission's Notice of Proposed Rulemaking in the above-captioned proceedings.¹ Lockheed Martin is a manufacturer of satellite systems operating or planning to

¹ *Expanding Flexible Use of the 3.7-4.2 GHz Band*, GN Docket No. 18-122, et al., Order and Notice of Proposed Rulemaking, FCC 18-91 (July 13, 2018) ("*NPRM*").

operate around the world in a variety of services and frequency ranges – including the fixed-satellite service (“FSS”) in the C-band frequency range at 3.7-4.2 GHz that is the subject of Commission proposals in the *NPRM*. Lockheed Martin is also a developer and manufacturer of a wide range of advanced systems, payloads, and platforms that operate or are planned for operation at various altitudes and in various frequency bands, including those that are the subject of the *NPRM* or are adjacent to the subject bands.

I. INTRODUCTION AND SUMMARY

Lockheed Martin comments on the *NPRM* to express its concerns with the Commission’s proposals to effectively reallocate the conventional C-band fixed-satellite service (“FSS”) downlink band at 3.7-4.2 GHz to satisfy “potential opportunities for additional terrestrial use – particularly for wireless broadband services”² The FSS industry has long provided critical services supporting a wide range of applications in the conventional C-band FSS frequencies (which include the companion uplink band at 5925-6425 MHz), and C-band satellite services continue to be in high demand in the United States and worldwide. Yet, despite acknowledging that it does not have accurate or complete information about the extent and significance of current FSS use of the 3.7-4.2 GHz band,³ the Commission is proposing to phase out all FSS uses that “would hamper new intensive terrestrial use of the band.”⁴

We recognize the FCC’s novel approach in potentially allowing some of the participants in the satellite services ecosystem to make marketplace choices. However, Lockheed Martin is

² *NPRM*, FCC 18-91, at 2.

³ *Id.* at 9 (¶ 16). The Commission neither has nor seeks information about planned FSS use of the 3.7-4.2 GHz band.

⁴ *Id.* at 12 (¶ 27).

unclear as to how the Commission will be able to align its priorities and determination with its statutory mandate to advance the public interest, convenience, and necessity. The Commission is making proposals based primarily (if not exclusively) on projected economic interests of actual and potential spectrum users; nowhere does it ask what impact the loss of C-band satellite services would have on the direct and indirect users of C-band satellite services, and nowhere does it meaningfully consider the protection of users in adjacent-band spectrum (including radio altimeter operations in the 4.2-4.4 GHz band) that have co-existed successfully for decades with the “extremely weak” signals from C-band satellites.

Lockheed Martin recognizes the value in a market-based approach to the development and use of radiofrequency spectrum. Lockheed Martin urges the Commission to recast this proceeding as a fundamental inquiry that seeks to develop a solid record on which to make decisions that balance the stated interests of wireless broadband providers along with the interests of those involved in the provision and use of C-band satellite services – providers and their customers. The Commission needs to gather the information it seeks in the *Order* portion of the *NPRM*; consider the information (along with relevant information on the legitimate spectrum requirements of the wireless broadband industry and the interests of others potentially affected by any substantive change in spectrum use at 3.7-4.2 GHz); and, if analysis warrants, develop a rational set of proposals that it duly and objectively considers necessary to advance the public interest, and not simply displace a user community. The Commission should embrace a balanced and equitable market-based approach that meaningfully benefits both satellite and terrestrial services in a way that allows both to develop, and that allows the marketplace to decide which one or ones will thrive.

II. DISCUSSION

A. The Commission Must Perform the Necessary Due Diligence

Spectrum reallocation decisions and proposals need to be based on more than an acknowledgment that a particular band or set of frequencies is suitable for a new use. Historically, there are requirements for demonstrations of demand on the part of the new entrant for that particular spectrum, and increasingly for sharing and compatibility studies to address the extent of current incumbent use and protection of present and future incumbent operations. It appears that very little, if any, of the foundation for a reallocation action is being laid in the *NPRM*.

On FSS use of the 3.7-4.2 GHz band, the Commission acknowledges that the record regarding current use of the band “is inaccurate and/or incomplete.”⁵ The record on current use should include an assessment of both direct and indirect use of C-band FSS spectrum, as well as an analysis of whether (and if so, how) FSS use could be accommodated or substituted for elsewhere if some or all of the spectrum were to be reallocated to incompatible terrestrial use. Indeed, this assessment should have been completed prior to the development of the detailed reallocation proposals that are advanced in the *NPRM*. The compression of normal timelines here suggests an urgency for action that has not been shown.

The Commission further seems to presume, without any real scrutiny, that an additional 500 MHz of prime “mid-band” spectrum is required in the immediate-to-foreseeable future for use by terrestrial broadband systems. Wireless broadband operators have of course indicated a desire for more spectrum, but that is not enough. Part of any rational analysis would include a statement

⁵ *NPRM*, FCC 18-91, at 9 (¶ 16).

as to why the spectrum available for wireless broadband use today (or in the near future following ongoing rulemaking proceedings and the upcoming decisions at the WRC-19) is not sufficient; how more efficient use could be made of existing wireless broadband spectrum allocations; and what requirements there are – and on what timetable – for additional spectrum access. This has been assumed, but not demonstrated in the *NPRM*.⁶

There is good reason to observe that deployment of high-powered, dense-coverage wireless broadband operations into the FSS downlink band at 3.7-4.2 GHz would require band segmentation in one form or another. It is long established that higher-power dense concentrations of terrestrial signals are incompatible with earth stations trying to receive very weak signals from tens of thousands of kilometers away. Nevertheless, there are many types of existing and planned FSS operations that would need to be grandfathered in and protected before even one additional hertz of spectrum in the band is made available for wireless broadband use – including telemetry links for GSO networks and in-band aviation uses (of which distribution of important meteorological information is a critical service). Aeronautical radionavigation service operations of radio altimeters in the 4200-4400 MHz band are noted in passing by the Commission, yet are not the subject of any specific protection limit proposals. The Commission also performs no analysis of its proposal to revive a formerly-rejected terrestrial-industry proposal to eliminate the full-band, full-azimuth coordination policy that has been rejected by the Commission multiple times in the past.⁷

⁶ Even where anecdotal supporting materials are cited, they either come from mobile industry interests or are broader documents that may include some discussion of a portion of the 3.7-4.2 GHz band.

⁷ *NPRM*, FCC 18-91, at 15-16 (¶¶ 38-40).

By pressing forward with specific and broad-ranging proposals for how the wireless broadband industry would gain permanent access to FSS spectrum in widespread use today, both domestically and internationally, while making only inquiries and seeking general comments about protection and continuation of FSS use, the Commission sends a strong signal that the fate of C-band satellite services is no longer of any importance in the development of U.S. spectrum policy. The Commission makes no pretext about its indifference to its FSS licensees and the users or the services provided in the 3.7-4.2 GHz band. FSS and other incumbent operations will be protected only if it is convenient for the Commission to do so without “hamper[ing] new intensive terrestrial use of the band.”⁸

The Commission’s failure to lay a proper regulatory foundation for its proposed actions, and the manner in which it is approaching the reallocation of a band that is being used in the United States and around the world for the provision of critical and vital services, is simply flawed. The Commission must take into account the nature of global U.S. leadership in the satellite manufacturing, operation, and service industry that it is now pushing aside in its pursuit of “5G leadership.”

⁸ *Id.* at 12 (¶ 26).

B. The Commission Must Ensure the Protection of C-Band Telemetry Operations, LEOP Services, Satellite Services Critical to Aviation, and Adjacent-Band Operations.

The Commission makes very clear in its *NPRM* that the main objective of this proceeding is to allow intensive terrestrial use of the 3.7-4.2 GHz band, and to facilitate the clearing of FSS downlink operations from that band in order to enable the achievement of its objective. Ubiquitous wireless broadband use (particularly by mobile broadband systems) represents an existential threat to the present use and continued development of C-band for satellite services.⁹

Lockheed Martin is aware that there are efforts by some in the satellite community – including operators of C-band satellite networks – to achieve a *de facto* segmentation of the 3.7-4.2 GHz band that would allow wireless broadband operations access to up to 200 MHz of the band, while concentrating satellite downlinks in the remaining portion of the band (*i.e.*, above 3.8 GHz).¹⁰ Lockheed Martin is not prepared to offer any specific comments at this juncture on the broad viability of the segmentation approach being suggested by some operators, and to observe

⁹ See, e.g., Comments of the Satellite Industry Association, GN Docket No. 18-122, at Section II, p. 8 (filed May 31, 2018) (“failure to apply and enforce separation distances that will adequately protect 4 GHz FSS operations from interference would have profound negative consequences, potentially undermining the continued reliable reception of video and audio programming by U.S. consumers across the country”).

¹⁰ See *Ex Parte* Presentations dated October 9, 2018 and October 23, 2018 in GN Docket Nos. 17-183 and 18-122 by the member companies of the C-Band Alliance. 100 MHz was the number initially advanced by the C-Band Alliance, and members asserted contemporaneously and that amounts of spectrum higher than 100 MHz will require a major “rearchitecting” of the band. See *Intelsat: losing 200 MHz or more megahertz of C-band will require new satellites*, Space News, Oct. 8, 2018, available at <https://spacenews.com/intelsat-losing-200-300-megahertz-of-c-band-will-require-new-satellites/>. In its most recent *ex parte* submission, the C-Band Alliance stated its intention to clear up to 200 MHz of spectrum in the 3.7-4.2 GHz band. This statement, however, is highly conditioned, and does not clarify whether the 200 MHz it intends to clear is contiguous spectrum at the lower end of the band or is subject to some other segmentation approach. C-Band Alliance October 23 *Ex Parte* Submission, at Attachment p. 2 (Oct. 23, 2018).

that some of the proponents of the segmentation approach have indicated that clearing of any amount of spectrum greater than 100 MHz would not be readily achievable given the manner in which satellite systems currently use the 3.7-4.2 GHz band. Nevertheless, Lockheed Martin emphasizes (as the operators themselves note) that a segmentation approach for even the lower 100 MHz or 200 MHz portion of the 3.7-4.2 GHz band must have an important caveat.

Under Commission rules, satellite operators locate their telemetry, telecommand, and control (“TT&C”) links at or near the edges of their service link bands.¹¹ This policy ensures that the sensitive telemetry links that are used in C-band FSS networks are not spread throughout the band in a way that hampers inter-satellite coordination in a two-degree spacing environment. In the case of the C-band, this means that many networks around the world have telemetry links within approximately 30 MHz of the 3700 MHz boundary.¹² If these links receive unacceptable or harmful interference from wireless broadband systems, they cannot function, and control of the satellite could be lost.¹³ Telemetry links at the 3700 MHz band edge are also used during orbit-raising and launch and early orbit phase (“LEOP”) operations. As the satellites are generally not

¹¹ 47 C.F.R. § 25.202(g)(1) (TT&C signals “may be transmitted in frequencies within the assigned bands that are not at a band edge only if the transmissions cause no greater interference and require no greater protection from harmful interference than the communications traffic on the satellite network or have been coordinated with operators of authorized co-frequency space stations at orbital locations within six degrees of the assigned orbital location”).

¹² 30 MHz is widely understood to be the extent of the “edge” of the 500 MHz FSS band at 3.7-4.2 GHz. Anything beyond that range for carriers more sensitive than standard traffic carriers would typically require a waiver of the rule or some other exception. There are networks in operation with telemetry carriers within 30 MHz of the 4200 MHz upper boundary as well.

¹³ Loss of a satellite due to telemetry-link interference at the 3700 MHz band edge would happen even if the service-link operations were to be restricted to the 3.8-4.2 GHz portion of the band. An operating satellite has no ability to relocate telemetry links to a different portion of the downlink band.

in a geostationary orbit during this period, which can run for several months after launch depending on the type of propulsion used on the spacecraft, there has to be full-azimuth capability for the earth stations operating as part of the LEOP network for the given launch.

The Commission must at a minimum ensure that any actions it takes does not risk in any way interference with band-edge telemetry signals at 3700 MHz, including for LEOP use. For on-station satellite networks, these protections – whether in the form of absolute prohibitions or exclusion zones with significant separation distances – must be full-time and permanent.¹⁴ For LEOP protection, there is a periodicity – *i.e.*, protection only has to be provided during the operations. There also are a limited number of earth stations that operate as part of global LEOP networks, and these are located primarily on or near the east and west coasts of CONUS and in the Hawaiian Islands. The specific protection requirements, and whether those requirements can be met with limits, exclusion zones, or otherwise depend on a number of factors – including the interfering system deployment and technical characteristics (such as e.i.r.p. density limits and base station beam downtilt). The protection criteria for FSS telemetry receive links in the 3.7-4.2 GHz range are found in the publications of the International Telecommunication Union (“ITU”).¹⁵

Lockheed Martin also emphasizes the need for the Commission to ensure protection of services provided in and near the FSS downlink band at 3.7-4.2 GHz to aviation users. These services include the NOAAPort signal that provides vital meteorological information to aircraft in flight over and around the United States. There is a vital, safety-of-life aspect to these

¹⁴ The Commission appears to recognize that this protection must be provided to TT&C links for the lifetime of the satellite network. *NPRM* FCC 18-92, at 60 (¶180).

¹⁵ See, e.g., ITU-R Recommendation S.1432-1, Apportionment of the allowable error performance degradations to fixed-satellite service (FSS) hypothetical reference digital paths arising from time invariant interference for systems operating below 30 GHz (2006).

transmissions. As the American Meteorological Society put it in an *ex parte* submission concerning the NOAAPort system:

Timely weather information is essential for assuring advanced warning of any adverse impacts to life and property of American citizens. The NOAAPort delivery mechanism is a long-standing method that achieves this objective and has advanced weather services, research, and industry in the United States and beyond. Licensed or unlicensed commercial wireless users could interfere with this transmission and interrupt the flow of data about potentially dangerous weather.¹⁶

Others in the aviation arena have noted the safety-of-life criticality of the NOAAPort information and of other C-band satellite transmissions.¹⁷

C. The Commission Has Not Considered Any International Ramifications of Its Proposed Reallocation of the 3.7-4.2 GHz Band from FSS to Wireless Broadband Services.

The Commission notes at the outset of the *NPRM* that a number of countries are evaluating the prospect of mobile broadband service in frequency bands that include portions of the 3.7-4.2 GHz band. In most of the mentioned cases, the bands under study or in pilot projects start below

¹⁶ Joint Comments of the American Meteorological Society, the American Geophysical Union, and the National Weather Association in GN Docket No. 18-122, at 3 (filed May 31, 2018).

¹⁷ See, e.g., Comments of Aviation Spectrum Resources, Inc. (“ASRI”), GN Docket No. 18-122, at 2 (filed May 31, 2018) (“C-band SATCOM is used worldwide for the backhauling of important aviation data from remote sites or as a redundant secondary link for emergencies should local infrastructure fail. The loss of a radar feed or air traffic control message for several minutes due to a thunderstorm over a control center is not a safe option for aviation to implement. Thus, C-band has become essential when other services cannot meet the required performance or are simply unavailable”). ASRI also noted that C-band satellite communications provides a high-level of availability for critical aviation use that is unavailable from Ku-band or other higher-band satellite networks. In other words, there is no substitute for C-band in terms of critical services to aviation. *Id.* at 1.

3.7 GHz and end at 3.8 GHz. Only Japan is noted to be studying a mobile allocation in any portion of the 3.7-4.2 GHz band above 3.8 GHz.¹⁸

There are no ITU-R studies underway to examine the impact of wireless broadband services on FSS receiving earth stations in the conventional C-band spectrum, and there are no agenda items or preliminary agenda items calling for such studies at least through the 2023 World Radiocommunication Conference. Although countries are, for better or worse, free to determine whether satellites will get or retain landing rights in their territories, the potential impact from wireless broadband services on the FSS certainly has cross-border impacts that need to be assessed further. In this proceeding alone, estimates of distances between wireless broadband systems and standard FSS receiving earth stations are on the order of 50-70 kilometers.¹⁹

The Commission has not made any effort to assess the impact of its decision on FSS operations in cross-border situations, and includes no provisions or proposals for the protection of such operations even where it would reallocate some or all of the 3.7-4.2 GHz band away from satellite use. This is a substantive deficiency in the *NPRM*.

C-band FSS is perhaps the most inherently international satellite service for geostationary-satellite orbit networks. Propagation considerations allow the use of beams that cover large swaths of territory from a single orbital location. This, in turn, affects the economies of scale for operators and users alike, and is what makes the conventional FSS frequencies at C-band so useful for the types of meteorological and aviation applications discussed above.

¹⁸ *NPRM*, 18-91, at 4.

¹⁹ See, e.g., Comments of the Satellite Industry Association, GN Docket No. 18-122, at 7 (filed May 31, 2018), citing projections from a mobile broadband proponent.

The Commission's proposal to reallocate the conventional C-band FSS downlink spectrum to terrestrial use without first detailing the protection mechanisms for incumbent services and applications in and adjacent to the 3.7-4.2 GHz band is likely to have what must be unintentional consequences internationally, risking serious disruption to consumers worldwide. Others around the world expect the United States to demonstrate leadership, and forward leading regulatory decisions on spectrum, that protect customers of incumbent services. The failure to do so risks customers of C-band FSS worldwide. There is an increasing uncertainty among the users of the capacity. Should other countries and regions follow the Commission's approach in not addressing and including protection details, the Commission will be responsible for that adverse customer impact. The Commission should instead demonstrate appropriate global regulatory leadership for consumers of existing services, and ensure that the satellite systems are not exposed to interference. The Commission's next steps in the NPRM must seek to correct the impression that it is only focused on future wireless consumers, rather than existing customers of satellite services.

III. CONCLUSION

The satellite industry has invested years of technical development and billions of dollars to provide affordable, reliable, high-capacity satellite services – including broadband and Internet connectivity – in the C-band FSS spectrum. The Commission's policy proposal to jettison an element of a critical U.S.-led industry that provides vital, irreplaceable services in favor of providing more terrestrial spectrum, where exclusive-licensed spectrum today lies fallow in many parts of rural America, would not seem to advance the broad public interest, convenience, and necessity.

As it continues its evaluation of these bands, any market-based approach should be balanced and equitable; it should meaningfully serve both existing customers of incumbent services, as well as future wireless use in a way that allows the marketplace to decide the spectrum's future. At the end of the day, the Commission's rules should maximize the spectrum available for satellite systems, both FCC and non-FCC space-station licensed, as well as any other emerging technologies that can demonstrate the ability to co-exist with reasonable sharing arrangements.

Respectfully submitted,

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